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Nonminimal coupling for the gravitational and electromagnetic fields: Traversable electric wormholes

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Abstract

We discuss new exact solutions of a three-parameter nonminimal Einstein-Maxwell model. The solutions describe static spherically symmetric objects with and without center, supported by an electric field nonminimally coupled to gravity. We focus on a unique one-parameter model, which admits an exact solution for a traversable electrically charged wormhole connecting two universes, one asymptotically flat the other asymptotically de Sitter ones. The relation between the asymptotic mass and charge of the wormhole and its throat radius is analyzed. The wormhole solution found is thus a nonminimal realization of Wheeler's idea about charge without charge and shows that, if the world is somehow nonminimal in the coupling of gravity to electromagnetism, then wormhole appearance, or perhaps construction, is possible. © 2010 The American Physical Society.

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